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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
JOHN DONOHUE, ET AL.	: EXAMINER: BERMAN, JASON
SERIAL NO: 10/500,005	:
FILED: FEBRUARY 14, 2005	: GROUP ART UNIT: 1795
FOR: METHOD OF FAULT DETECTION FOR MATERIAL PROCESS SYSTEM	:

APPEAL BRIEF UNDER 37 C.F.R. §41.31

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

This appeal brief is submitted in response to the Final Rejection dated March 18, 2009 and is appropriate because claims in the application are twice rejected. A Notice of Appeal was timely filed on June 18, 2009.

I. Real Party in Interest

The real party in interest in this appeal is the assignee, Tokyo Electron Limited.

II. Related Appeals and Interferences

Appellants, Appellants' legal representatives, and the assignees are not aware of any appeals or interferences which will directly affect or be directly affected by this appeal or have a bearing on the Board's decision in this appeal.

III. Status of Claims

Claims 1-24 are pending in this case. Claims 1-24 have been rejected under 35 U.S.C. §103(a) as explained in detail below.

Claims 1-6, 8-9, 12-15, and 23-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Flamm et al. (U.S. Patent No. 5,711,849, hereafter "Flamm") in view of Gerrish (U.S. Patent No. 5,770,922). Claims 1-5, 10-15, and 23-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Farber et al. (U.S. Patent No. 6,232,134, hereafter "Farber") in view of Gerrish. Claims 7 and 10-11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Flamm in view of Gerrish and Angell et al. (U.S. Patent No. 5,658,423, hereafter "Angell"). Claims 16-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Flamm in view of Gerrish and to Scott et al. (U.S. Patent No. 5,601,869, hereafter "Scott").

The final rejection of claims 1-24 form the basis for this appeal. The attached claim appendix includes a clean copy of appealed Claims 1-24.

IV. Status of Amendments

A Request for Reconsideration was filed on May 18, 2009, in response to an Office Action dated March 18, 2009, and resulted in an Advisory Action dated June 5, 2009. The Advisory Action indicated that the Request for Reconsideration had been considered but did not place the application in condition for allowance. No amendments have been submitted after issuance of the Advisory Action.

V. Summary of Claimed Subject Matter[1]

The two independent claims, Claims 1 and 14, and dependent Claims 23 and 24, are summarized below with support for the claim elements indicated in parentheses. The pending dependent claims stand or fall with independent Claims 1 and 14. Specifically, Claims 2-13, and 23 depend from Claim 1, and Claims 15-22 and 24 depend from Claim 14.

(INDEPENDENT CLAIM 1): A method of material processing, the method comprising:

characterizing a process, said characterizing comprising measuring a process performance parameter at a plurality of positions on a sample (page 11, lines 18-19 and page 12, lines 8-10) and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process (page 12, lines 16-20), wherein said measured signature comprises the at least one spatial component in spectral space (Figs. 6B and 7B; page 13, lines 4-14);

optimizing said process, said optimizing comprising identifying a reference signature of said process (Fig. 18B; page 20, lines 12-25); and

comparing said measured signature of said process with said reference signature for said process (Fig. 18D; page 21, lines18-22), wherein said comparing comprises determining a difference signature representing a difference between the measured signature and reference signature (page 21, lines 21-22), and determining a process fault by comparing said

[1] It is Appellants' understanding that, under the rules of practice before the Board of Patent Appeals and Interferences, 37 C.F.R. § 41.37(c) requires that a concise explanation of the subject matter recited in each independent claim be provided with reference to the specification by page and line numbers and to the drawings by reference characters. However, Applicants' compliance with such requirements anywhere in this document should in no way be interpreted as limiting the scope of the invention recited in all pending claims. Further, references to the specification and drawings are only exemplary and do not include every instance of support in the specification for claimed subject matter.

difference signature with a threshold (page 21, line 25), wherein said process fault occurs when said threshold is exceeded (page 21, line 25 to page 22, line 1).

(INDEPENDENT CLAIM 14): A system for material processing (Fig. 1), the system comprising:

process chamber (Fig. 1, 10),

device configured to measure and adjust at least one controllable process parameter (Fig. 1, 12; page 5, lines 23-24),

device configured to measure at least one process performance parameter (Fig. 1, 14; page 5, lines 24-25), and

controller capable of characterizing a process (Fig. 1, 55; page 5, line 25 to page 6, line 3), said characterizing comprising:

measuring a process performance parameter at a plurality of positions on a sample (page 11, lines 18-19 and page 12, lines 8-10) and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process (page 12, lines 16-20), wherein said measured signature comprises the at least one spatial component in spectral space (Figs. 6B and 7B; page 13, lines 4-14);

optimizing said process, said optimizing comprising identifying a reference signature of said process (Fig. 18B; page 20, lines 12-25);

comparing said measured signature of said process with said reference signature for said process (Fig. 18D; page 21, lines18-22), wherein said comparing comprises determining a difference signature representing a difference between the measured signature and reference signature (page 21, lines 21-22); and

determining a process fault by comparing said difference signature with a threshold (page 21, line 25), wherein said process fault occurs when said threshold is exceeded (page 21, line 25 to page 22, line 1).

(DEPENDENT CLAIM 23): The method according to Claim 1, further comprising identifying whether a process variation is global or local based on the signature of spatial components (page 14, lines 4-21) .

(DEPENDENT CLAIM 24): The system according to Claim 14, wherein said controller is further capable of identifying whether a process variation is global or local based on the signature of spatial components (page 6, lines 2-3; page 14, lines 4-21).

VI. Grounds of Rejection to be Reviewed on Appeal

The first ground to be considered under appeal is whether independent Claims 1 and 14 are unpatentable over Flamm in view of Gerrish under 35 U.S.C. §103(a).

The second ground to be considered under appeal is whether independent Claims 1 and 14 are unpatentable over Farber in view of Gerrish, under 35 U.S.C. §103(a).

The third ground to be considered under appeal is whether dependent Claims 23 and 24 are unpatentable over Flamm in view of Gerrish under 35 U.S.C. §103(a).

The fourth ground to be considered under appeal is whether dependent Claims 23 and 24 are unpatentable over Farber in view of Gerrish under 35 U.S.C. §103(a).

VII. Argument

The Rejection of Independent Claims 1 and 14 as Unpatentable Over Flamm in View of Gerrish Under 35 U.S.C. §103(a) is Improper.

Independent Claims 1 and 14 stand rejected under 35 U.S.C. §103(a) as unpatentable over Flamm in view of Gerrish. This ground of rejection is untenable, and accordingly, should not be sustained.

Independent Claim 1 recites, *inter alia*, "measuring a process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process, wherein said measured signature comprises the at least one spatial component in spectral space." No proper combination of Flamm and Gerrish discloses or suggests these features.

Flamm is directed to a method of selecting appropriate etching parameters in a plasma etching process.[2] Fig. 1 of Flamm shows a plasma etching apparatus with a plate stack zone 17, and Fig. 1A shows a etched substrate 21 from the plate stack zone. Flamm describes that a top surface 27 of the film includes a convex region as an etching profile, and the etching profile occurs by way of different etch rates on the substrate.[3] Fig. 3 of Flamm shows a process in which an etching profile is analyzed to optimize etching parameters.[4] (see col. 5, lines 16-61).

With regard to the combination of Flamm and Gerrish, the Office Action dated March 18, 2009 asserts Flamm as teaching almost every element of Claim 1. In particular, while the Office Action does not explicitly state what element in Flamm corresponds to the claimed "measurement data" of Claim 1, the Office Action appears to interpret that a desired etch

[2] Flamm, col. 1, ll. 53-57.
[3] Id., col. 4, ll.1-6; and col. 5, ll. 44-47.
[4] Id., col. 7, ll. 15-24.

profile for a substrate described in Flamm corresponds to the "signature" of Claim 1.[5] The Office Action acknowledges that Flamm fails to disclose "the actual conversion of the data into spectral space,"[6] which it asserts Gerrish as teaching.

Gerrish describes a voltage and current probe 22, as shown in Fig. 1, which samples a radio frequency (RF) voltage and current of the applied RF power as it enters the input to a plasma chamber 20.[7] Gerrish describes computing the amplitudes and relative phase of the voltage and current baseband signals in a digital signal processor.[8] Voltage samples and current samples are processed as a complex waveform and the DSP performs a complex Fast Fourier Transform operation on the complex waveform.[9]

Thus, Gerrish describes transforming a complex waveform obtained from voltage and current samples which are input into a plasma chamber into spectral space.

Applicants note that when a combination of references is asserted as teaching every element of a claim, both the asserted modification, or how the references are combined, as well as the asserted motivation for the combination, or why one of ordinary skill in the art would combine the references, must be specified in the rejection. MPEP § 706.02(V) sets out the requirement for asserting the modification. As to the asserted motivation, the Court recently reiterated the requirement of MPEP § 2143.01 by stating that a "patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art." KSR Int. Co. v. Teleflex Inc., 82 USPQ2d 1385, 1389 (2007). The Court stated the importance of identifying "a reason that would have prompted a person of ordinary skill in the art to combine the elements as the new invention does." *Id.*

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[5] Official Action at 4, ll. 5-7.
[6] Id. at 4, ll. 1-2.
[7] Gerrish, col. 4, ll. 33-36.
[8] Id., col. 5, ll. 55-60.
[9] Id., col. 6, ll. 34-47.

In this case, the Office Action of March 18, 2009 asserts, at page 4, a modification of Flamm such that the fast Fourier transform operation described in Gerrish is applied to the etch profile data of Flamm "because spectral data analysis can be used for accurate control of plasma operations."

However, the etch rate profile data of Flamm characterizes a relative etch rate at different spatial coordinates of an etched substrate in the processing chamber. Gerrish, on the other hand, applies a Fourier transform on voltage and current sample data from a voltage/current probe which samples the applied RF power to a processing chamber. Even though both Flamm and Gerrish are related to a processing chamber, the etch rate profile data of Flamm is related to a physical profile of a substrate placed inside the chamber, and is completely different than the input voltage and current samples being input to the chamber as described by Gerrish. Thus, there is no apparent reason as to why one of ordinary skill in the art would take the teaching of Gerrish, which describes performing a Fourier transform on voltage and current waveform data from a voltage/current probe, and then perform a Fourier transform on the measured etch rate profile data of a substrate described in Flamm. The Office Action's stated motivation of "because spectral data analysis can be used for accurate control of plasma operations" does not take into account that the data involved in Gerrish and Flamm are directed to completely separate aspects of a plasma processing chamber. In other words, the Office Action appears to be suggesting that the teaching of a Fourier transform to a specific type of data in Gerrish makes it obvious to apply a Fourier transform to any type of data related to a plasma processing chamber. Applicants submit that even within the context of a processing chamber, the Office Action's asserted combination of Gerrish and Flamm is arbitrary and is not supported by a rational reason or motivation to combine.

Therefore, the examiner has failed to establish a prima facie case of obviousness because the cited references cannot be properly combined to disclose or suggest "measuring a

process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process, wherein said measured signature comprises the at least one spatial component in spectral space," as recited in independent Claim 1.

Because Flamm and Gerrish cannot be properly combined to teach or suggest every element of Claim 1, Applicants respectfully request that the rejection of independent Claim 1 under 35 U.S.C. §103(a), based on Flamm and Gerrish, be withdrawn.

Independent Claim 14, though differing in scope and statutory class from Claim 1, patentably defines over the combination of Flamm and Gerrish for similar reasons as Claim 1. Thus, Applicants respectfully request that the rejection of independent Claim 14 under 35 U.S.C. §103(a), based on Flamm and Gerrish, be withdrawn.

The Rejection of Independent Claims 1 and 14 as Unpatentable Over Farber in View of Gerrish Under 35 U.S.C. §103(a) is Improper.

Independent Claims 1 and 14 stand rejected under 35 U.S.C. §103(a) as unpatentable over Farber in view of Gerrish. This ground of rejection is untenable, and accordingly, should not be sustained.

Independent Claim 1 recites, *inter alia*, "measuring a process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process, wherein said measured signature comprises the at least one spatial component in spectral space." No proper combination of Farber and Gerrish discloses or suggests these features.

Farber discloses a method and apparatus for monitoring wafer (substrate) characteristics based on a surface charge distribution pattern on the wafer.[10] Fig. 2 of Farber shows a desirable reference charge distribution pattern 200 of a wafer following exposure of a wafer to plasma.[11] Figs. 3 and 4 of Farber show problem charge distribution patterns which are different than the desirable reference charge distribution pattern due to possible deviation in the processing procedure.[12]

With regard to the combination of Farber and Gerrish, the Office Action dated March 18, 2009 asserts Farber as teaching almost every element of Claim 1. In particular, the Office Action interpreted that a measured surface charge distribution on a wafer described in Farber corresponds to the "signature" of Claim 1.[13] The Office Action acknowledges that Flamm fails to disclose "the actual conversion of the data into spectral space,"[14] which it asserts Gerrish as teaching.

However, the voltage and current data from an RF probe being analyzed in Gerrish is different than the surface charge distribution data on a wafer being analyzed in Farber. Even if a "surface charge distribution pattern" is related to a current value in general, the actual analysis of voltage and current data waveform data from a RF probe in Gerrish, in its application and purpose, is different than the analysis of surface charge distribution data on a wafer in Farber. Applicants submit that the Office Action has not shown any rational basis as to why one of ordinary skill in the art would learn from Gerrish to apply a Fourier transform to the surface charge distribution data of Farber. Again, the Office Action appears to be suggesting that the teaching of a Fourier transform to a specific type of data in Gerrish makes it obvious to apply a Fourier transform to any type of data related to a plasma processing

[10] Farber, Abstract.
[11] Id., col. 4, ll. 52-55.
[12] Farber, col. 4., l. 66 to col. 5, l. 24.
[13] Official Action at 7, ll. 20-22.
[14] Id. at 4, ll. 1-2.

chamber. Applicants submit that even within the context of a processing chamber, the Office Action's asserted combination of Gerrish and Farber is arbitrary and is not supported by a rational reason or motivation.

Therefore, the examiner has failed to establish a prima facie case of obviousness because the cited references cannot be properly combined to disclose or suggest "measuring a process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process, wherein said measured signature comprises the at least one spatial component in spectral space," as recited in independent Claim 1.

Because Farber and Gerrish cannot be properly combined to teach or suggest every element of Claim 1, Applicants respectfully request that the rejection of independent Claim 1 under 35 U.S.C. §103(a), based on Farber and Gerrish, be withdrawn.

Independent Claim 14, though differing in scope and statutory class from Claim 1, patentably defines over the combination of Farber and Gerrish for similar reasons as Claim 1. Thus, Applicants respectfully request that the rejection of independent Claim 14 under 35 U.S.C. §103(a), based on Farber and Gerrish, be withdrawn.

The Rejection of Dependent Claims 23 and 24 as Unpatentable Over Flamm in View of Gerrish Under 35 U.S.C. §103(a) is Improper.

Dependent Claims 23-24 stand rejected under 35 U.S.C. §103(a) as unpatentable over Flamm in view of Gerrish. This ground of rejection is untenable, and accordingly, should not be sustained.

Dependent Claim 23 recites, *inter alia*, "identifying whether a process variation is global or local based on the signature of spatial components." No proper combination of Flamm and Gerrish discloses or suggests these features.

As was described above with regard to independent Claim 1, Flamm is directed to a method of selecting appropriate etching parameters in a plasma etching process.[15] Flamm also describes that an etching apparatus 50 shown in Fig. 2 has a power source 59 and a temperature and pressure controller 67.[16] In addressing the features of Claim 23, the Office Action takes the position that Flamm discloses the control of RF power and pressure and temperature, and that each of these variables being measured and controlled are inherently either global or local.[17]

However, the Office Action has only attempted to show that in Flamm, the variables being measured or controlled are either global or local variables. However, the Office Action has not addressed the actual features of Claim 23, and has not shown that the combination of Flamm and Gerrish discloses or suggest "***identifying*** whether a process variation is global or local ***based on the signature of spatial components***," as recited in Claim 23.

Furthermore, in the Advisory Action dated June 5, 2009, the examiner states the following in response to the Applicants' Request for Reconsideration filed on May 18, 2009.[18]

> This argument is not found persuasive because the nature of a fault being local or global is inherent to the process. When spectral analysis is performed by Flamm in view of Gerrish or Farber in view of Gerrish, the location on the spectrum obtained of the fault signature will inherently either correlate to either the high or low end of the spectrum which inherently correlate to local and global process variation. Any analysis of fault with spectral space

[15] Flamm, col. 1, ll. 53-57.
[16] Flamm, col. 4, ll. 19-27.
[17] Official Action at 7, ll. 11-13.
[18] Advisory Action at 2, ll. 12-16.

> will therefore inherently involve identification of local or global process variation.

Thus, the examiner appears to be stating that because the asserted combination of Flamm and Gerrish are alleged to disclose the claimed "signature," then identifying whether a process variation is global or local based on that signature is inherent.

Applicants respectfully submit that the assertion of inherency is insufficient to show that Farber in view of Gerrish inherently disclose "identifying whether a process variation is global or local based on the signature of spatial components," as recited in Claim 23. The rejection fails to show "that the alleged inherent characteristic necessarily flows from the teachings of the applied prior art"[19] (Emphasis added).

Additionally, "to establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'"[20]

Here, the Advisory Action first states that "the nature of a fault being global or local is inherent to the process." However, Claim 23 is not reciting whether or not "the nature" of a fault is global or local. Next, the examiner states that "[w]hen spectral analysis is performed by Flamm in view of Gerrish or Farber in view of Gerrish, the location on the spectrum obtained of the fault signature will inherently either correlate to either the high or low end of the spectrum which inherently correlate to local and global process variation."

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[19]See MPEP 2112 (emphasis in original) (citation omitted). See also same section stating that "[t]he fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic," (emphasis in original). See also In re Robertson, 49 USPQ2d 1949, 1951 (Fed. Cir. 1999) ("[t]o establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill,'" citing Continental Can Co. v. Monsanto Co., 948 F2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991); and "[i]nherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient," Id. at 1269 (citation omitted)).

[20] *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

Again, Claim 23 is not reciting whether or not the location of a fault on a spectrum "correlates" to being a local or global process variation. Finally, the examiner asserts "any analysis of fault within spectral space will inherently involve identification of local or global process variation." However, the actual "identifying" of whether a process variation is global or local based on a signature of spatial components is a deliberate action and cannot just be inherent to "any analysis" of fault within spectral space without it being explicitly mentioned. In other words, the examiner appears to have just attempted to show that the combination of Farber and Gerrish establish the conditions for performing the "identifying," as defined in Claim 23. However, the examiner has not shown at all why "any analysis" of fault in spectral space must ***necessarily*** involve "identifying whether a process variation is global or local based on the signature of spatial components," such that it is inherent in the combination of Farber and Gerrish.

Therefore, the examiner has failed to establish a prima facie case of obviousness because the cited references cannot be properly combined to disclose or suggest "identifying whether a process variation is global or local based on the signature of spatial components," as recited in dependent Claim 23.

Because Flamm and Gerrish cannot be properly combined to teach or suggest every element of Claim 23, Applicants respectfully request that the rejection of dependent Claim 23 under 35 U.S.C. §103(a), based on Flamm and Gerrish, be withdrawn.

Dependent Claim 24, though differing in scope and statutory class from Claim 23, patentably defines over the combination of Farber and Gerrish for similar reasons as Claim 23. Thus, Applicants respectfully request that the rejection of dependent Claim 24 under 35 U.S.C. §103(a), based on Flamm and Gerrish, be withdrawn.

The Rejection of Dependent Claims 23 and 24 as Unpatentable Over Farber in View of Gerrish Under 35 U.S.C. §103(a) is Improper.

Dependent Claims 23-24 stand rejected under 35 U.S.C. §103(a) as unpatentable over Farber in view of Gerrish. This ground of rejection is untenable, and accordingly, should not be sustained.

Dependent Claim 23 recites, *inter alia*, "identifying whether a process variation is global or local based on the signature of spatial components." No proper combination of Farber and Gerrish discloses or suggests these features.

The Office Action states that Farber discloses the determination of an etch rate by measuring a charge distribution and feedback control of power, gas, pressure and wafer position in the chamber.[21] The Office Action further states that each of these variables measured and controlled is inherently either global or local.[22] Thus, the Office Action rejects Claim 23 as unpatentable over Farber in view of Gerrish according to a similar rationale as it used for the combination of Flamm in view of Gerrish, which was discussed above. The Advisory Action of June 5, 2009 also asserts that Claim 23 is unpatentable over Farber in view of Gerrish for the same reasons as the combination of Flamm in view of Gerrish.[23] Thus, Advisory Action suggests that the combination of Farber and Gerrish inherently disclose all the features of Claim 23.

Therefore, for the same reasons as discussed above with regard to Flamm and Gerrish, Applicants submit that the examiner has failed to establish a prima facie case of obviousness with regard to Farber and Gerrish because the cited references do hot inherently disclose or suggest "identifying whether a process variation is global or local based on the signature of spatial components," as recited in dependent Claim 23.

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[21] Official Action at 11, ll. 13-15.
[22] Id. at 11, ll. 15-16.
[23] Advisory Action at 2, ll. 12-16.

Because Farber and Gerrish cannot be properly combined to teach or suggest every element of Claim 23, Applicants respectfully request that the rejection of dependent Claim 23 under 35 U.S.C. §103(a), based on Farber and Gerrish, be withdrawn.

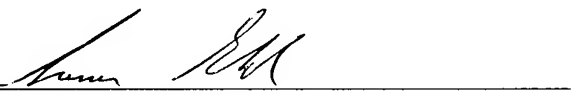
Dependent Claim 24, though differing in scope and statutory class from Claim 23, patentably defines over the combination of Farber and Gerrish for similar reasons as Claim 23. Thus, Applicants respectfully request that the rejection of dependent Claim 24 under 35 U.S.C. §103(a), based on Farber and Gerrish, be withdrawn.

VIII. Conclusion

Based on the discussion above, a reversal of the Examiner's decision is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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IX. Claim Appendix

Claim 1: A method of material processing, the method comprising:

characterizing a process, said characterizing comprising measuring a process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process, wherein said measured signature comprises the at least one spatial component in spectral space;

optimizing said process, said optimizing comprising identifying a reference signature of said process; and

comparing said measured signature of said process with said reference signature for said process, wherein said comparing comprises determining a difference signature representing a difference between the measured signature and reference signature, and determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is exceeded.

Claim 2: The method according to Claim 1, further comprising performing said process on a substrate.

Claim 3: The method according to Claim 2, wherein said substrate is at least one of a wafer or a liquid crystal display.

Claim 4: The method according to Claim 1, wherein said process performance parameter is at least one of etch rate, deposition rate, etch selectivity, etch feature anisotropy, etch feature critical dimension, film property, plasma density, ion energy, concentration of

chemical specie, temperature, pressure, mask film thickness, and mask pattern critical dimension.

Claim 5: The method according to Claim 1, wherein said transforming comprises applying a discrete Fourier transform to the measured data to provide said at least one spatial component as Fourier harmonics.

Claim 6: The method according to Claim 1, wherein said characterizing further comprises determining a relationship between said measured signature and at least one controllable process parameter associated with the measured signal, using a multivariate analysis.

Claim 7: The method according to Claim 6, wherein said multivariate analysis comprises principal components analysis.

Claim 8: The method according to Claim 6, wherein said multivariate analysis comprises design of experiment.

Claim 9: The method according to Claim 6, wherein said at least one controllable process parameter comprises at least one of process pressure, RF power, gas flow rate, cooling gas pressure, focus ring, electrode spacing, temperature, film material viscosity, film material surface tension, exposure intensity, and depth of focus.

Claim 10: The method according to Claim 1, wherein said optimizing comprises improving spatial uniformity of said measurement data.

Claim 11: The method according to Claim 1, wherein said optimizing comprises minimizing said at least one spatial component in spectral space.

Claim 12: The method according to Claim 1, wherein said measuring comprises obtaining a multi-dimensional scan of data for said process performance parameter.

Claim 13: The method according to Claim 12, wherein said multi-dimensional scan of data is a two- dimensional scan of data for said process performance parameter.

Claim 14: A system for material processing, the system comprising:

process chamber,

device configured to measure and adjust at least one controllable process parameter,

device configured to measure at least one process performance parameter, and

controller capable of characterizing a process, said characterizing comprising:

measuring a process performance parameter at a plurality of positions on a sample and transforming the measurement data into at least one spatial component in spectral space to identify a measured signature of said process, wherein said measured signature comprises the at least one spatial component in spectral space;

optimizing said process, said optimizing comprising identifying a reference signature of said process;

comparing said measured signature of said process with said reference signature for said process, wherein said comparing comprises determining a difference signature representing a difference between the measured signature and reference signature; and

determining a process fault by comparing said difference signature with a threshold, wherein said process fault occurs when said threshold is exceeded.

Claim 15: The system according to Claim 14, wherein said process chamber is an etch chamber.

Claim 16: The system according to Claim 14, wherein said process chamber is a deposition chamber comprising at least one of chemical vapor deposition and physical vapor deposition.

Claim 17: The system according to Claim 14, wherein said process chamber is a photoresist coating chamber.

Claim 18: The system according to Claim 14, wherein said process chamber is a dielectric coating chamber comprising at least one of a spin-on-glass system and a spin-on-dielectric system.

Claim 19: The system according to Claim 14, wherein said process chamber is a photoresist patterning chamber.

Claim 20: The system according to Claim 19, wherein said photoresist patterning chamber is an ultraviolet lithography system.

Claim 21: The system according to Claim 14, wherein said process chamber is a rapid thermal processing chamber.

Claim 22: The system according to Claim 14, wherein said process chamber is a batch diffusion furnace.

Claim 23: The method according to Claim 1, further comprising identifying whether a process variation is global or local based on the signature of spatial components.

Claim 24: The system according to Claim 14, wherein said controller is further capable of identifying whether a process variation is global or local based on the signature of spatial components.

X. Evidence Appendix

(NONE)

XI. Related Proceedings Appendix

(NONE)